UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON, D. C.
H. H. BENNETT, CHIEF

ADVANCE REPORT

on the

SEDIMENTATION SURVEY OF FRANKLINTON RESERVOIR

FRANKLINTON, NORTH CAROLINA

May 16-18, 1938

by

Mark P. Connaughton and Leland H. Barnes

Sedimentation Studies
Division of Research
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In cooperation with

North Carolina Agricultural Experiment Station
Raleigh, North Carolina
I. O. Schaub, Acting Director

ABSTRACT

The sedimentation survey of Franklinton Reservoir was made as part of a Nation-wide study of rates and causes of reservoir silting, especially as influenced by soil erosion and land use.

Franklinton Reservoir is a very small basin-type water-supply reservoir 1 mile west of Franklinton, N. C. Its 724-acre drainage basin, lying near the eastern edge of the Piedmont Upland, has gently to moderately rolling topography and light-colored rather erodible sandy soils developed on acidic crystalline rocks. The area has undergone moderate to moderately severe sheet erosion and some gullying. About 60 percent of the area is cultivated, the principal crops being cotton, corn, and tobacco, and the remaining 40 percent is largely forested. Agriculture in this region dates from about 1750.

The reservoir sediment ranges from medium to coarse silty sand in the delta deposits, which comprise nearly half of the total sediment volume, to silt and clay in the bottom-set beds near the dam. Determinations on four samples gave an average dry weight of 67 pounds per cubic foot in place. The deposits average less than 1 foot in thickness over most of the basin, but maximum accumulations of 4 and 6 feet, respectively, occur in the two deltas.

Erosion data on the drainage area indicate that most of the sediment originates in cultivated upland areas. Calculations based on (1) the total volume of soil moved from place in the drainage area, as computed from detailed erosion data, and (2) the total period of agricultural activity (about 200 years) indicate that the average time required for erosion of 1 inch of soil in the area as a whole is about 36 years. In contrast, the volume of sediment in the reservoir indicates a minimum net removal of 1 inch of soil in 145 years. This wide discrepancy is explained by colluvial and alluvial deposition in the drainage area and bypassing of sediment through the reservoir.

The survey data indicate that sediment is accumulating in the reservoir at an average rate equivalent to about 35 cubic feet a year per acre of drainage area, entailing a loss of original storage of 1.6 percent per year, or 21 percent to the date of survey. This rate, in view of the already limited capacity of the reservoir, emphasizes a pressing need for protection from further silting. As most of the sediment originates in the cultivated upland areas, the only feasible method of long-range control is considered to be

widespread application of soil conserving measures centered on these areas.

INTRODUCTION

This report is one of a series of advance reports on reservoir silting investigations made by the Section of Sedimentation Studies, Division of Research, Soil Conservation Service. Each reservoir survey is part of a Nation-wide study of the condition of American reservoirs with respect to storage reduction by silting. The ultimate objective of these studies is to determine rates and causes of reservoir silting, in order to derive a practical index to (1) the useful-life expectancy of existing or contemplated reservoirs, and (2) differences and changes in regional erosion conditions as influenced both by natural factors and by land use.

The sedimentation survey of Franklinton Reservoir was made during the period May 16 to May 18, 1938. The survey party consisted of Leland H. Barnes, chief of party, and Alvin T. Talley, of the Section of Sedimentation Studies, assisted by members of the staff of the Cedar Creek Soil Conservation project (NC-5) located at Franklinton. Arrangements for the survey were made by Carl B. Brown of the Section of Sedimentation Studies. A detailed conservation map of the drainage area, showing soils, erosion, and land use conditions, was prepared by J. B. Watts and Woodrow Haskins of the Cedar Creek project staff, under the direction of P. N. Massey, project manager.

Laboratory studies of sediment samples were made under the direction of Jack L. Hough, of the Section of Sedimentation Studies, in the laboratories of the city filtration plant at High Point, N. C. These facilities were made available by the city of High Point.

The cooperation and assistance of the Franklinton municipal officials, especially P. P. Purnell, chairman of the water committee, greatly facilitated the sedimentation survey of Franklinton Reservoir. The city furnished information on the history and cost of the reservoir and placed a boat at the disposal of the party.

G. W. Forster, head of the Department of Economics and Rural Sociology, University of North Carolina, advised and aided in economic studies related to the various reservoir silting investigations carried out in North Carolina in the spring of 1938.

GENERAL INFORMATION

Location (fig. 1):

State: North Carolina.

County: Franklin.

Distance and direction from nearest city: The dam is 1 mile west of Franklinton.

Drainage and backwater: Sallie Kearney Creek, a tributary of Taylor Creek, which in turn flows northward to join the Tar River approximately 4.5 miles north of Franklinton.

Ownership: City of Franklinton.

Purpose: Municipal and industrial water supply.

Description of dam.

Franklinton Reservoir is impounded by a gravity-type earth-fill dam (fig. 2) with an over-all length of about 300 feet, a height of 16 feet above the stream channel, a crest width of 10 feet, and a maximum width at the base of 40 feet. A concrete core wall extends the entire length of the dam. The dam extends northwestward across the valley just below the junction of the two main branches of Sallie Kearney Creek. Both the downstream and the upstream faces of the dam have a 2 1/2:1 slope. The exposed part of the dam is grass-covered.

The spillway, at the northwest end of the dam approximately over the original stream channel, is a concrete structure with a crest width of 28 feet. Vertical concrete and masonry wing walls extend approximately 20 feet downstream from the dam (fig. 3). The spillway crest is 3 feet below the top of the dam (or 13 feet above the original stream channel) at elevation 20 (local datum). The water intake well, fed by an 8-inch valve, is opposite the center of the dam and 35 feet upstream.

The total cost of the reservoir, including construction of the dam and purchase of property, was $45,000.

Date of completion of dam: January 1925. At the time of the survey the lake was 13.3 years old.

DRAINAGE AREA OF FRANKLINTON RESERVOIR
FRANKLINTON, N.C.

Figure I.

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Figure 2.--General view of Franklinton Dam and Reservoir.

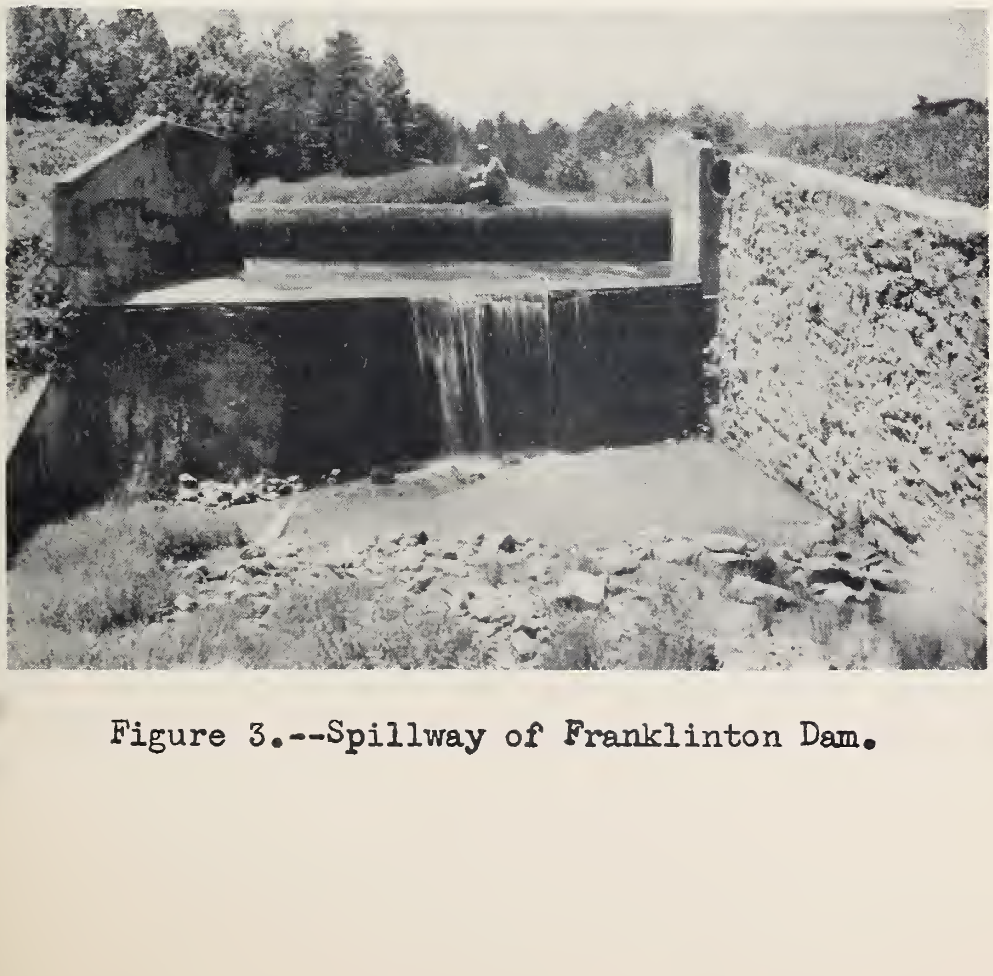

Figure 3.--Spillway of Franklinton Dam.

Length of lake: Originally 860 feet from the dam to the head of backwater on the west arm and 840 feet on the south arm. The present lengths are 660 feet and 640 feet, respectively, each arm having been shortened 200 feet by sedimentation.

Area of lake at spillway stage:

	Acres
Original..	6.4
At date of survey..	5.8
Reduction..	0.6

Storage capacity to spillway level:

	Acre-feet	
Original..........................	34.7	(11,306,995 gals.)
At date of survey..................	27.3	(8,895,705 gals.)
Reduction by sedimentation.......	7.4	(2,411,290 gals.)

General character of reservoir basin.

The lake is made up of two comparatively wide arms extending south and west, respectively, from the dam (fig. 4, following p. 15). Widths decrease fairly regularly from 290 feet near the dam to 140 feet at the present head of backwater on the west arm and 80 feet on the south arm. The heads of both arms have very prominent deltas, each extending above crest downstream to a point about 200 feet from the original heads of the lake.

Slopes adjacent to the lake shore range from 7 to 20 percent, averaging about 12 percent. Practically the whole shore line is flanked by a heavy growth of trees, shrubs, and grass.

The submerged stream channels, 15 to 20 feet in average width and 2 to 6 feet in depth below the flood plain, follow fairly straight courses through the basin. The average original gradients were 79 and 89 feet per mile on the south and west arms, respectively.

Area of drainage basin.

The area, as determined by planimeter measurement of the drainage-basin map prepared by technicians of the Cedar Creek Soil Conservation project at Franklinton, is 1.13 square miles, or 724.3 acres. However, owing to the artificial diversion of drainage from one small terraced field near the dam in 1932, the present drainage area is 718.1 acres. This latter figure should be used in future surveys.

General character of drainage basin.[1]

Geology.--The drainage area tributary to Franklinton Reservoir lies near the eastern edge of the Piedmont Upland section of the Piedmont Plateau province. The geology of this drainage area has not been mapped. Because of the absence of outcrops a more detailed geologic study of the surrounding country than is justified would have been required for exact determination of the character of bedrock underlying the drainage area. A belt of schistose rock, tentatively correlated with the Wissahickon schist to the north, occupies parts of Vance, Granville, and Wake Counties, outcropping between the towns of Henderson and Oxford to the north of the drainage area and Raleigh and Morrisville to the south. If, as supposed, this belt is continuous between these points of outcrop, it should underlie or pass very close to the drainage area. On the east this belt of schist is in contact with an extensive belt of granite that has been mapped in Franklin County as the Louisburg granite. This formation, in the vicinity of its contact with the Wissahickon schist, is usually highly metamorphosed into an irregularly banded pink and gray granite-gneiss of fine to medium texture.

Regardless of the exact position of the contact between these two formations with reference to the drainage area, it can be said in general that the area is underlain by more or less schistose acidic crystalline rocks.

Topography and drainage.--The drainage area constitutes a part of a broad dissected upland plain that, geomorphically, is in a stage of early maturity. The topography in general is gently rolling to rolling, although the moderately broad interstream areas break off rather sharply near the major streams. The maximum relief in the drainage area is about 100 feet. Slopes range from about 5 percent on the uplands to 13 percent on the valley sides, and average about 7 percent for the area as a whole.

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[1]Much of the following information, particularly on erosion, slopes, soils, and land use, was obtained from a conservation map of the drainage area made by field personnel of the Cedar Creek Soil Conservation project (NC-5), which adjoins the Franklinton Reservoir drainage area on the north.

Slope classes and the proportionate areas of land in each are given in the following tabulation.

	Percent
0 - 3 percent	2.17
3 - 7 percent	70.12
7 - 10 percent	14.31
10 - 14 percent	6.56
Over 14 percent	6.84
Total drainage area	100.00

The area is well drained. The drainage pattern, although dendritic on the whole, is somewhat angular in detail, being characterized by predominating northeast and northwest trends. (See fig. 1.) This angularity is probably a reflection of the structure of the underlying rock. The streams are generally intermittent in the headwater areas, although several are fed by permanent springs. Steep gradients and comparatively wide, shallow channels are the general rule on the major streams.

Soils.--All the soils of the drainage area, with the exception of narrow areas of alluvial material, are residual from the underlying rocks, believed to be predominantly light-colored granites and gneisses. Three important soil groups are represented in the drainage area. These soil groups and their proportionate areas within the watershed are listed in the following tabulation.

	Percent
1. Heavy clay loam; relatively deep, with somewhat friable topsoil and heavy, rather impermeable clay subsoil	2.68
2. Medium to coarse sandy loams; relatively shallow, with friable topsoil and heavy, slowly permeable clay subsoil	96.92
3. Undifferentiated variable-textured alluvial soils; generally somewhat sandy and permeable	.40
Total drainage area	100.00

The 3 groups comprise 14 distinct soil types, of which 13 are residual soils of the Appling, Cecil, Louisburg, Worsham, Helena, and Wilkes series, and 1 is alluvial material classed as meadow. The surface soils are dominantly sandy, light-colored, and contain only a small quantity of organic matter. These relatively loose and friable topsoils, together with the predominantly

heavy, slowly permeable clayey subsoils, offer conditions very favorable to rapid run-off and serious soil losses.

Erosion conditions.--Moderate to moderately severe sheet erosion prevails throughout the drainage area. About 58 acres (8 percent of the area) is subject to gullying, although only 2.5 acres has been totally destroyed. Few of the gullies are very deep, because the soils are generally shallow. Moderate to severe sheet erosion and gullying are confined almost entirely to cultivated and pasture lands. Little of the forested area shows more than slight sheet erosion.

Conservation-survey data on erosion conditions in the drainage area are given in the following tabulation.

	Percent
No apparent erosion	1.79
Slight sheet erosion (less than 25 percent of topsoil removed)	17.08
Moderate sheet erosion (25 - 50 percent of topsoil removed)	27.83
Moderately severe sheet erosion (50 - 75 percent of topsoil removed)	42.35
Moderately severe sheet erosion and occasional gullies (1- 5 per acre)	5.88
Severe to very severe sheet erosion (more than 75 percent of topsoil and some subsoil removed)	3.04
Severe to very severe sheet erosion and occasional gullies	1.50
Occasional shallow gullies	.21
Land totally destroyed by gullying	.32
Total drainage area	100.00

Land use.--Early agriculture in the drainage area, probably dating back to about 1750, was devoted mainly to the production of corn and small grains, although some livestock was raised. Tobacco and cotton first became important crops about 1850 and increased in importance thereafter. Present-day agriculture consists mainly of the production of tobacco and cotton as cash crops and corn, together with smaller quantities of hay and grain, as a subsistence crop. Forest growth consists chiefly of old-field pine, post oak, white oak, black oak, red maple, poplar, hickory, and some birch, together with a scattered undergrowth of holly, dogwood, redbud, and sweetgum.

At present (1938) the drainage area is 58 percent cultivated, the main crops being cotton, corn, tobacco, and grasses, in the relative order of acreage. Only 2.5 percent of the land is used for pasture. The remaining 39.5 percent is forested, with old-field pine predominating over the hardwoods..

Mean annual rainfall: 45.18 inches, as measured at the cooperative United States Weather Bureau station at Louisburg, N. C., approximately 9 miles east of the reservoir.

Draft on reservoir.

The average monthly draft on the reservoir is about 3,000,000 gallons. The maximum draft during the summer season is 3,500,000 gallons per month. Inflow into the reservoir is equal to consumption 9 months out of the year, but during the summer months inflow is insufficient to supply normal draft.

METHOD OF SURVEY

Water and sediment volumes in Franklinton Reservoir were determined by the contour method of survey.[2] Horizontal control for the survey consisted of two instrument stations, from which all the shore line and the locations of soundings and spud measurements were mapped. The basin was mapped on a scale of 1 inch to 100 feet by plane table and telescopic alidade. Water depth and sediment thickness were determined at 140 points at well-spaced intervals throughout the reservoir. The soundings and spud measurements were carefully located by stadia, the stadia rod being held firmly on the reservoir bottom. Original and existing contours of the reservoir basin were mapped on the basis of these measurements. (See fig. 4, following p. 15.)

Capacity curves (fig. 5) showing the original and 1938 storage capacities of the basin were constructed from the contour maps.

The contact between the reservoir deposits and the underlying valley materials is sharp and easily identified except in the delta areas. Over most of the reservoir bottom the underlying valley material is a dark-gray to almost black sandy loam that is much more compact than the sediment. The upper layer of the underlying material

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[2] Eakin, H. M. Silting of Reservoirs. U. S. Dept. Agr. Tech. Bull. 524: 129-137, 1936.

contains a considerable proportion of humus, and its upper surface is locally marked by a definite rootlet zone. Within the submerged channel gravel is the normal underlying material.

Four samples of the reservoir sediment were taken at well-distributed locations in the basin. These samples were collected with the 1 1/2-inch tubular sampler previously described.[3] Samples were taken in iron pipe nipples 1 1/2 inches in diameter and 4 inches long, which were immediately removed from the sampler and capped with threaded airtight iron covers for shipment to the laboratory.

SEDIMENT DEPOSITS

Character of Sediment

The sediment in Franklinton Reservoir ranges in texture from medium to coarse silty sand in the delta areas to silt and clay in the lower basin. The color is uniformly grayish throughout. Although some thin mats or lenses of leafy matter were encountered in the delta deposits, the organic content of the reservoir sediment in general was low. As a rule the sediment was fairly compact and adhered readily to the spud, although some of the surface sediment in the lower basin was very soft and "soupy". Deposits less than 3 feet below crest have been exposed to aeration during the seasonal low-water stages and consequently have become fairly compact.

The moisture content and dry weight of a small representative quantity of each of the sediment samples were determined by Jack L. Hough of this Section. From these values, the porosity and dry weight per cubic foot of the sediment were calculated by assuming a specific gravity of 2.65.

The location, depth relations, and dry weight per cubic foot of the sediment samples collected are listed in table 1.

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[3] Connaughton, Mark P., and Hough, Jack L. Advance Report on the Sedimentation Survey of Burlington Reservoir, Burlington, North Carolina. U. S. Soil Conserv. Serv. SCS-SS-28: 12, 1939.

Table 1.--Bottom-sediment samples from Franklinton Reservoir, Franklinton, N. C.

Sample No.	Location	Water depth	Silt thickness	Penetration[1]	Dry Weight per cubic foot
		Feet	Feet	Feet	Pounds
1..............	Near spillway........	9.0	1.6	1.0	65
2..............	Near delta on west arm................	4.5	1.2	.5	45
3..............	Opposite Station 501.	6.0	1.6	1.0	56
4..............	Near end of delta on south arm..........	.6	1.1	.5	2/ 90
Average[3]......	....	......	....	......	67

[1]Depth to which lower end of sampler penetrated sediment.
[2]This sample is representative of sediment at depths of less than 3 feet. The higher volume weight is due to compaction by aeration.
[3]Weighted average, obtained by applying the average weight of samples 1-3 to the volume of sediment below the zone of aeration and the weight of sample 4 to the volume of aerated sediment above the lower limit of draw-down.

Distribution of Sediment

Variations in sediment thickness throughout the basin are illustrated graphically in figure 6. The isopachs, or lines connecting points of equal sediment thickness, depict the general pattern of distribution within the basin. The tendency toward greater thicknesses within the submerged channels as compared with the adjacent flood plain and submerged valley slopes, and within the delta areas as compared with the lower basin, are plainly illustrated. It is also obvious from this map that greater volumes of sediment have accumulated in the delta areas than in the lower basin. Comparative capacity losses and sediment volumes for the two delta areas and the lower basin are presented in table 2.

Figure 6.

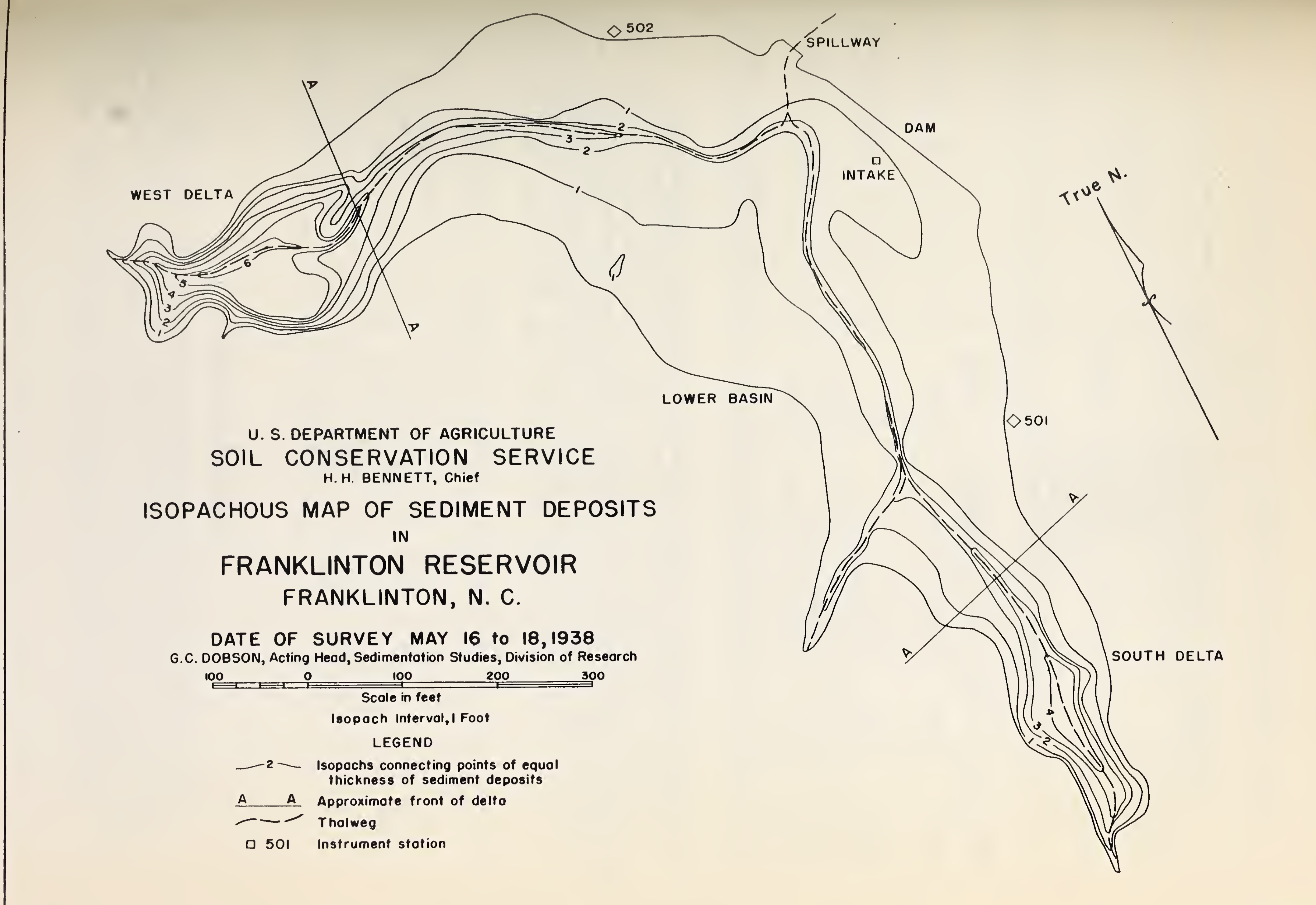

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Table 2.--Distribution of sediment in Franklinton Reservoir, Franklinton, N. C.

Section	Original storage capacity			Sediment	
	Volume	Relation to original capacity of reservoir	Loss	Volume	Relation to total sediment in reservoir
	Acre-feet	Percent	Percent	Acre-feet	Percent
Lower basin..............	30.4	87.7	13.2	4.0	54.1
West delta..............	2.7	7.7	83.3	2.2	30.3
South delta.............	1.6	4.6	72.9	1.2	15.6
Total deltas..........	4.3	12.3	79.4	3.4	45.9
Total reservoir.........	34.7	100.0	21.3	7.4	100.0

The sediment thickness within the narrow submerged channel is generally little more than 2 feet in the lower basin and 4 feet in the delta on the south arm, but it reaches a maximum of 6 feet in the delta on the west arm, where sediment accumulation has obliterated the original channel entirely. The average sediment thickness within the lower basin is only 0.8 foot, compared with an average of 1.8 feet in the south delta and 3 feet in the west delta.

The general features of sediment distribution within the reservoir are entirely in accord with conditions to be expected in a basin-type reservoir fed by comparatively small streams that have steep gradients and carry a predominantly sandy load. In view of the seasonal fluctuations in water level, it is to be expected that some of the delta deposits are subject to redistribution during the summer low-water stages, but such influences are insufficient to obscure the normal trend of sedimentation.

Origin of Sediment

Study of the conservation-survey map of the drainage area indicates that by far the largest proportion of the lake sediment comes from the cultivated parts of the gently rolling upland areas. As indicated on the map of the drainage area (fig. 1), practically all the steep valley slopes are wooded and are thus effectively

protected against accelerated erosion. Only about 9 percent of the forested area has undergone sheet erosion of more than moderate degree, whereas 48 percent shows only slight sheet erosion. Pasture land has suffered greater erosion, ranging from moderate sheet erosion to total destruction. Of the cultivated land, 68 percent has been affected by moderate sheet erosion and 16 percent by more severe erosion.

Stream-bank erosion above the reservoir and wave erosion along the lake shores appear to have contributed only a very minor proportion of the lake sediment.

RELATION OF RESERVOIR SEDIMENTATION TO THE TOTAL EROSIONAL OUTPUT OF THE DRAINAGE AREA

The average rate of sediment accumulation in Franklinton Reservoir was determined by this survey to be 0.57 acre-foot per year, which is equivalent to about 34.6 cubic feet a year per acre of drainage area. If the average dry weight of the reservoir sediment is 67 pounds per cubic foot,[4] and that of the soil in the drainage area is 97.3 pounds per cubic foot,[5] the measured rate of sedimentation indicates that the time required to remove 1 inch of soil from the entire area is about 145 years. However, this calculation of the erosion rate, based on sediment accumulation in the reservoir, ignores two important factors in the disposal of erosional debris from the drainage area; namely, temporary deposition of sediment above the reservoir, and bypassing of a fraction of the finer-grained suspended load over the spillway. Accurate data showing the importance of these two factors are not available. Although no areas of redeposited material were mapped during the conservation survey of the drainage area, this does not preclude the existence of deposits less than 6 inches in thickness or of limited areal extent, which are not ordinarily delineated. The total volume of such unmapped deposits might conceivably be large in comparison with the total volume of reservoir sediment. In addition to probable alluvial and colluvial deposits, a minimum of 0.3 acre-foot of sediment was estimated, on the basis of field observations, to have accumulated above

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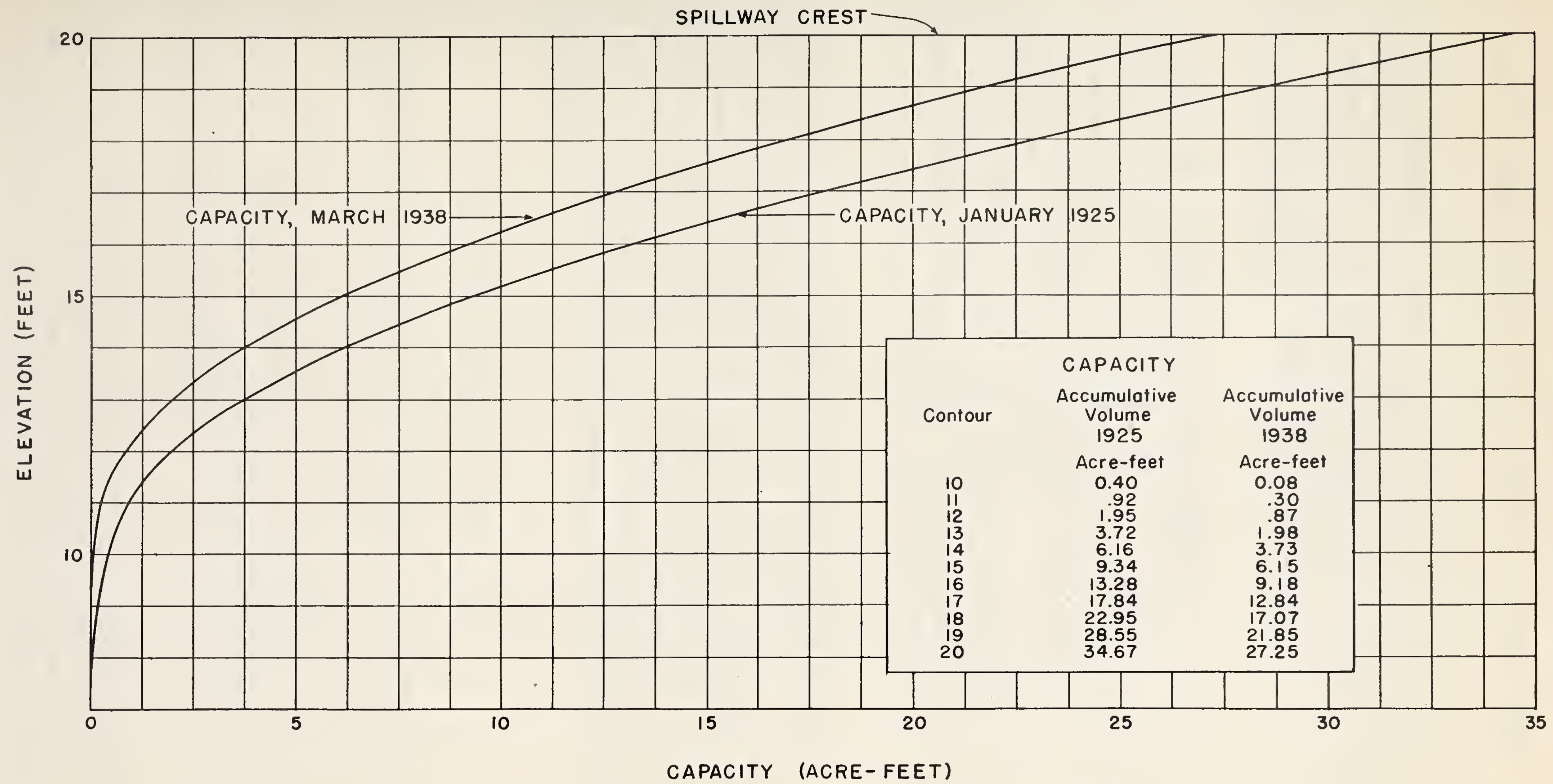
[4]See table 1, p. 10.

[5]Based on the volume weights of samples from the surface and two upper horizons of a set of three fine sandy loams (corresponding approximately to the principal soil types of this area) given by Middleton, H. E., Slater, C. E., and Byers, H. C. The Physical and Chemical Characteristics of the Soils from the Erosion Experiment Stations--Second Report. U. S. Dept. Agr. Tech. Bull. 430: 21, 1934.



CAPACITY

Contour	Accumulative Volume 1925	Accumulative Volume 1938
	Acre-feet	Acre-feet
10	0.40	0.08
11	.92	.30
12	1.95	.87
13	3.72	1.98
14	6.16	3.73
15	9.34	6.15
16	13.28	9.18
17	17.84	12.84
18	22.95	17.07
19	28.55	21.85
20	34.67	27.25

Figure 5.-Capacity curves of Franklinton Reservoir, Franklinton, N.C.

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crest level in the delta areas at the head of the two arms of the reservoir.

Owing to a complete lack of data on discharge over the spillway and of turbidity records for the reservoir water, it is impossible to even estimate the volume of fine-grained sediment that has been bypassed through the reservoir as suspended load. This also might conceivably represent a large fraction of the total erosional output of the drainage area.

It is possible to calculate approximately the volume of soil moved from place in the drainage area on the basis of data from the conservation-survey map of the area. From the extent of topsoil loss and the percentages of land under each erosion classification (see p. 7), it has been computed that approximately 4,000 acre-inches of topsoil has been moved from place in a period of about 200 years, since the advent of agricultural activities in the area. These figures indicate that the time required to remove 1 inch of topsoil from the entire drainage area is approximately 36 years, in contrast with 145 years as calculated from reservoir sedimentation data.

By using the conservation-survey data and assuming a uniform erosion rate, it has been calculated that 22 acre-feet of soil was moved from place in the drainage area in the 13.3-year interval between the construction of the reservoir and the sedimentation survey. Of this volume, 7.6 acre-feet, or about 35 percent, was deposited in the reservoir, and 0.3 acre-foot, or about 1 percent, was deposited above crest adjacent to the reservoir, leaving about 64 percent to be accounted for in scattered upstream deposits and in sediment bypassed over the spillway.

CONCLUSIONS AND RECOMMENDATIONS

The sedimentation survey of Franklinton Reservoir revealed a storage capacity loss of more than 21 percent up to May 1938, indicating an average depletion in the 13.3 years of storage of 1.60 percent a year. In view of the fact that the normal reservoir inflow is insufficient to supply municipal needs during the drier months, this rate of storage depletion is alarming. A pressing need for the application of all feasible methods of minimizing sediment accumulation in the reservoir is indicated.

The construction of debris barriers and similar engineering structures on the streams above the reservoir, and extensive planting of vegetation in the delta areas to encourage above-crest deposition of sediment, might serve to reduce the rate of storage depletion, but

it is evident that the ultimate solution of the silting problem lies in the control of sediment production at its source. The application of scientific soil conserving measures throughout the drainage area, particularly on cultivated and pasture lands, offers the only feasible method of long-range sediment control.

The quantitative results of the detailed sedimentation survey of Franklinton Reservoir are summarized in the tabulation on the following page.

Summary of data on Franklinton Reservoir, Franklinton, N. C.

	Quantity	Unit
Age[1]	13.3	Years
Watershed area[2]	1.13	Sq. miles
	724.3	Acres
Reservoir:		
Area at spillway stage:		
Original	6.4	Acres
At date of survey	5.8	Acres
Storage capacity to spillway level:		
Original	34.7	Acre-feet
At date of survey	27.3	Acre-feet
Capacity per sq. mile of drainage area:[2]		
Original	30.71	Acre-feet
At date of survey	24.16	Acre-feet
Sedimentation:		
Measured sediment volume	7.4	Acre-feet
Volume of sediment removed during period[3]	0.2	Acre-foot
Total sediment	7.6	Acre-feet
Average annual accumulation:		
From entire drainage area	0.57	Acre-foot
Per 100 sq. miles of drainage area[4]	50.9	Acre-feet
Per acre of drainage area:[4]		
By volume	34.59	Cubic feet
By weight[5]	1.16	Tons
Depletion of storage:		
Loss of original capacity:		
Per year	1.60	Percent
To date of survey	21.33	Percent

[1] Storage began in January 1925; date of survey, May 16 - 18, 1938.

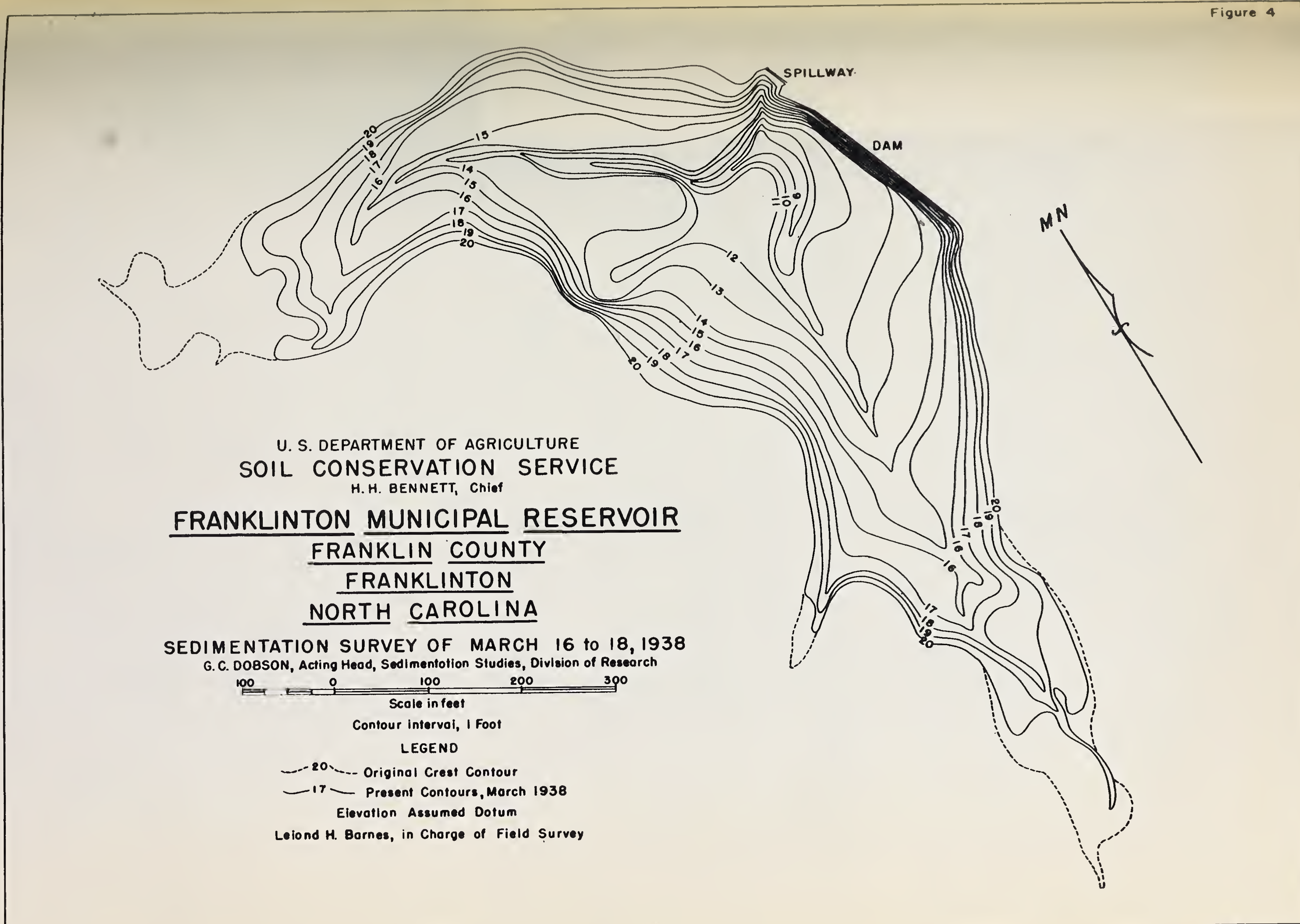
[2] Including area of lake.

[3] Records of the city reveal a total of 0.21 acre-foot of sand removed from the west delta region in 1933 for construction purposes.

[4] Excluding area of lake.

[5] Assuming average weight of 1 cubic foot of sediment is 67 pounds, as determined from four sediment samples (table 1).

Figure 4



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